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THE PLANT DISEASE REPORTER

Issued By

Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

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U.S. Department of Agriculture

Volume XXV · Number 20

November 1, 1941

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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THE PLANT DISEASE SURVEY

DIVISION OF MYCOLOGY AND DISEASE SURVEY

Volume XXV November 1, 1941 Number 20

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Paul R. Miller and Richard Weindling report the results of the fourth cotton boll rot survey, page 519.

CHECK LIST REVISION

Freeman Weiss

PINUS -- continued.

Cytospora pinastri Fr., needle cast ? Me., N. J.

Dacryomyces spp., common on decaying wood; one sp. (unnamed) invades sapwood and causes wood stain of hard pines in the South.

Dasyscypha spp., commonly saprophytic on branches and twigs, as D. arida (Phill.) Sacc. in the Western States; D. agassizii (Berk.& Curt.) Sacc., widespread; D. oblongospora Hahn & Ayers in N. E. States, and others.

D. ellisiana (Rehm) Sacc., on branches & twigs of native pines and causing cankers on introduced pines in Eastern States.

D. pini (Brunch.) Hahn & Ayers, branch and twig canker, on 5-needle pines. Pacific N. W. and Michigan.

Diplodia spp., on logs and timber causing blue-gray stain, also on branches, twigs, and roots; especially D.? megalospora Berk. & Curt. and D. natalensis Pole-Evans in the South, and D. pinastri (Lév.) Grove (=Sphaeropsis ellisii Sacc.?). Widespread.

Elytroderma deformans (Weir) Darker, needle cast, witches'-broom. On various pines, chiefly in the Western States, also in the Southeast.

Endoconidiophora coerulescens Münch and E. moniliformis (Hedgc.) Davidson, gray sapwood stain. On hard pines in the South.

Fomes spp., wood rot of standing trees, logs and timber, especially:

F. annosus (Fr.) Cke., root and butt rot, white spongy heart rot. Chiefly northern, from New England to Pacific N. W.

F. officinalis (Vill. ex Fr.) Faull, brown cubical heart rot. Pacific Coast, N. Rocky Mt., and N. E. States.

F. pini (Brot. ex Fr.) Karst. (Trametes pini Brot. ex Fr.), red ring rot, butt rot, white pocket heart rot -- frequent in living trees. Widespread.

F. pinicola (Sw. ex Fr.) Cke., brown crumbly rot of trunks and logs. Widespread.

F. roseus (Alb. & Schw. ex Fr.) Cke., brown cubical rot of trunks and logs. Widespread.

F. subrosea (Weir) Overh., brown cubical rot of trunks and logs. Widespread.

Fusarium spp., seedling blight, seed rot. Frequent and widespread but spp. poorly defined; pathogenicity demonstrated especially in the following: F. arthrosporioides Sherb., F. sambucinum Fckl., and F. sporotrichioides Sherb., and also in some strains of F. moniliforme Sheld., F. oxysporum Schlecht. and F. solani (Mart.) App. & Wr.

Ganoderma lucidum (Leyss. ex Fr.) Karst., wood rot. Me., Mich.

Graphium rigidum Pers. ex Sacc. and G. rubrum Rumbold, gray wood stain. On hard pines in the South.

Herpotrichia nigra Hartig, brown felt blight. On snow-buried foliage especially at high altitudes in the West.

PINUS -- continued.

Hypoderma spp., needle cast, tar spot:
H. desmazierii Duby, commonly on white pine or sometimes others. Eastern States.
H. hedgcockii Dearn., on hard pines. S. E. States.
H. lethale Dearn., gray blight of hard pines. Eastern and Gulf States.
H. pedatum Darker, on P. radiata. Calif.
H. pini (Dearn.) Darker, on P. monophylla. Calif. and Nev.
H. saccatum Darker, on P. edulis. Colo. and N. Mex.
Hypodermella spp., needle cast, tar spot:
H. ampla (Davis) Dearn., on P. banksiana. Great Lakes States.
H. arcuata Darker, on P. lambertiana. Calif.
H. cerina Darker, on P. contorta and P. ponderosa. Calif.
H. concolor (Dearn.) Darker, on P. contorta. Colo. to Idaho and Mont.
H. lacrimiformis Darker, on P. attenuata. Calif. and Oregon.
H. limitata Darker, on P. radiata. Calif.
H. medusa Dearn., on P. contorta and P. ponderosa. Calif. and Colo.
H. montana Darker, on P. contorta. Calif. to Idaho and Oregon
H. montivaga (Petr.) Dearn., on P. contorta. Colo. to Mont. and Ore.
Lasiosphaeria pezizula (Berk. & Curt.) Sacc., grayish -- olive wood stain of various pines. Southern States.
(Lecanosticta acicola (Theum.) Syd.): Systremma acicola.
Lentinus lepideus Fr., sapwood rot, or sometimes heart rot, of living trees; also on logs and timber. Widespread.
Lenzites spp., wood rot of logs, slash, and timber; especially L. saepiaria Wulf. ex Fr., also L. trabea Pers. ex Fr. Widespread.
(Leptostroma pinastri Desm.): Lophodermium pinastri.
Lophodermium nitens Darker, needle cast of 5-needle pines. Pacific N. W. and N. E. States.
L. pinastri (Schrad. ex Fr.) Chev., needle cast of various pines. Widespread.
Merulius spp., wood rot of logs and slash; especailly M. aureus Fr. and M. tremellosus Schrad. ex Fr., also M. lachrymans Jacq. ex. Fr., dry rot of structural timber. Widespread.
Mycosphaerella acicola (Cke. & Harkn.) Lindau, on needles. Calif.
Naemacyclus niveus (Pers. ex Fr.) Sacc., needle cast, of various pines. Occasional.
Neofuckelia pinicola Zeller & Goodding, on cankered branches associated with Atropellis. Pacific N. W.
Peniophora spp., wood rot of logs and slash; especially P. gigantea (Fr.) Mass. Widespread.
Peridermium. For spp. having known telial stages see Coleosporium and Cronartium.
Pestalotia (Pestalozzia) funerea Desm., on senescent needles of various pines; widespread; seedling root rot, Md.
Phacidium infestans Karst., snow blight of juvenile plants. N.E.States.
Phoma spp., on twigs and cones. Doubtfully parasitic and sometimes confused with Diplodia and Sphaeropsis; spp. reported include

PINUS -- continued.

P. harknessii Sacc., Calif. and Mass.; P. pinicola (Zopf) Sacc., Oregon; P. strobiligena Desm., Mich.

Phymatotrichum omnivorum (Shear) Dug., root rot. Texas.

Physalospora obtusa (Schw.) Cke., on branches and cones, also causing decay of seed. Occasional in East.

Phytophthora cactorum (Leb. & Cohn) Schroet., seedling blight. N. E. and Lakes States.

P. cinnamomum Rands, Md.

Polyporus spp., wood rot of logs and slash, sometimes root, butt, and heart rot of living trees. Spp. most frequently and widely reported, chiefly as saprophytes, include P. abietinus Dicks. ex. Fr.; P. amorphus Fr.; P. borealis Fr.; P. cinnabarinus Jacq. ex Fr.; P. fibrillosus Karst.; P. fragilis Fr.; P. gilvus (Schw.) Fr.; P. guttulatus Pk.; P. hirtus Fr.; P. lapponicus Romell; P. leucospongia Cke. (the last 3 chiefly in the West); P. palustris Berk. & Curt. in the South; P. tsugae (Murr.) Overh.; P. versicolor L. ex Fr.; and P. volvatus Pk.

P. anceps Pk. (P. ellisianus (Murr.) Long), red-ray rot, heartwood rot, of P. contorta and P.ponderosa. Rocky Mt. and S. W. States.

P. circinatus Fr., root and butt rot, white pocket heart rot. New England to Minn., Pacific N. W.

P. schweinitzii Fr., root and butt rot, brown cubical heart rot. Widespread.

P. sulphureus Bull. ex Fr., butt rot, brown cubical heart rot. Widespread but chiefly in the West on pines.

Poria spp., wood rot of logs, slash and timber. Numerous spp. common and widespread, chiefly as saprophytes: P. incrassata (Berk. & Curt.) Burt, dry rot of structural timber; P. purpurea (Fr.) Cke.; P. taxicola Pers. ex Bres.; P. vaporaria Pers. ex Fr.; and others.

P. cocos Wolf, on roots. S. E. States.

P. subacida Pk., spongy root rot. Widespread.

Pullularia pullulans (DBy.) Berkhout, gray wood stain. Southern States.

Pythium spp., damping off. Cosmopolitan. Reports usually vague as to sp. but the following have been shown to be parasitic on pines: P. aphanidermatum (Edson) Fitz., P. debaryanum Hesse and P. ultimum Trow.

Rhabdospora pini (Berk. & Curt.) Sacc., on branches.

Rhizoctonia solani Kühn, damping off. Cosmopolitan.

R. sylvestris Melin ?, ectotrophic mycorhiza. N.E.States.

Rhizopogon parasiticus Coker & Totten, ectotrophic mycorhiza. N.Car.

Schizophyllum commune Fr., on logs and stumps. Occasional.

(Septoria acicola (Thuem.) Sacc.): Systremma acicola.

* Sphaeropsis ellisii Sacc., twig blight, seedling blight. New England to Tenn. and Nebr. On various pines, especially P. nigra var. austriaca.

Stereum spp., wood rot of logs, slash, and occasionally standing trees: S. abietinum Pers. ex Fr., S. ambiguum Pk., and S. pini Fr.,

* Published by Saccardo as S. ellisi, which may have been a typographical error, as it is spelled ellisii in the index. The Recommendations governing orthography in the Rules of Nomenclature prescribe the ii form for epithets derived from specific names ending in a consonant (except -er).

PINUS -- continued.

chiefly in N. E. States; S. rugisporum (Ell. & Ev.) Burt in the West; S. sanguinolentum Alb. & Schw. ex Fr., top rot, white pocket rot, New England to Pacific N. W.

Systremma acicola (Dearn.) Wolf & Barbour (Scirrhia acicola (Dearn.) Siggers), brown spot of needles. On hard pines, especially P. palustris, in the S. E. and Southern States, also the Pacific N. W. Conidial stage long known as Septoria acicola (Thuem.) Sacc. = Lecanosticta acicola (Thuem.) Syd.

Thelephora terrestris Ehr. ex Fr., smothering of seedlings. N. Rocky Mts., occasionally in East.

Trametes spp., wood rot of logs and timber: T. americana Overh. (T. odorata of American authors), T. isabellina Fr. (T. tenuis Karst.), T. serialis Fr., T. variiformis Pk. Widespread but chiefly in the North.

Valsa spp., on branches and twigs. ? canker: V. abietis Fr.; V. colliculus Wormsk. ex Fr., in N. E. States; V. kunzei Fr.; V. pini Alb. & Schw. ex Fr.; and V. superficialis Nit., canker of introduced pines, Mich.

Mycorhiza. Ectotrophic mycorhizas of pines are of widespread occurrence in the U.S., especially in Eastern forests, less so in those of the Rocky Mts., and have been held to be examples of root parasitism. Only a few of the fungus components have been identified, as Amanita muscaria L. ex Fr., Boletus bicolor Pk., B. brevipes Pk., B. chromipes Frost, B. eximius Pk., B. granulatus L. ex Fr., Cantharellus cibarius Fr., Russula lepida Fr., and Scleroderma vulgare Hornem. In some cases parasitism of seedling roots has been demonstrated, e.g. Rhizoctonia sylvestris (= Mycelium radicis atrovirens ?) and Rhizopogon parasiticus.

PINUS ALBICAULIS, See P. MONTICOLA*
PINUS APACHECA, See P. PONDEROSA

PINUS ARISTATA Engelm., BRISTLECONE PINE. Growth Regions 9, 10, 11, 13, 14; cult. Zone V. Including P. BALFOURIANA Murr., FOXTAIL PINE, in G. R. 4.

Arceuthobium campylopodum, Engelm. forma cyanocarpum (A.Nels.) Gill, dwarf mistletoe. Calif., Utah.

Bifusella linearis (Pk.) Höhn., tar spot needle cast. Calif.

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* As there are about 40 native spp. of pines in the U.S.A. and 10 or more exotic spp. are cultivated here, it would lengthen the Check List unduly to list the diseases reported on each host sp. separately, especially since many organisms occur on a number of hosts. Accordingly the Pinus spp. are arranged here in groups which are based primarily upon botanical relationship but also reflect similarity of geographical or ecological distribution and of economic utilization, especially in the lumber industry.

PINUS -- continued.

Fomes pinicola (Sw. ex Fr.) Cke., brown crumbly heart rot. Colo.
Neopeckia coulteri Pk., brown felt blight. Calif.
Polyporus schweinitzii Fr., root & butt rot. Colo.

PINUS ARIZONICA, See P. PONDEROSA.
PINUS ATTENUATA, See P. CONTORTA.
(PINUS AUSTRALIS): P. PALUSTRIS.
(PINUS AYACAHUITE), See P. STROBIFORMIS under P. MONTICOLA.
PINUS BALFOURIANA, See P. ARISTATA.

PINUS BANKSIANA Lamb., JACK PINE. Growth Regions 23, 24, 26, 27; cult., Zone II.

Armillaria mellea Vahl ex Fr., root rot. Mich., Minn.
Atropellis piniphila (Weir) Lohman & Cash, canker. S. Dak.
A. tingens Lohman and Cash, canker. N. Car., Pa.
Coleosporium campanulae (Pers.) Lév., C. helianthi (Schw.) Arth., C. solidaginis (Schw.) Thüm., and C. sonchi-arvensis (Pers.) Lév., needle rust. (O,I). Conn. to Nebr.
Cronartium comandrae Pk., Comandra blister rust (O,I). Mich., Minn., Wis.
C. comptoniae Arth., sweetfern blister rust (O,I). Me. to N.J. and Minn.
C. quercuum (Berk.) Miyabe, Eastern gall rust (O,I). Conn., Mich., Minn., Wis.
Fomes annosus (Fr.) Cke., F. pini (Brot. ex Fr.) Karst, F. pinicola (Sw. ex Fr.) Cke., and F. roseus (Alb. & Schw. ex Fr.) Cke., butt & heartwood rot. General.
Hypodermella ampla (Davis) Dearn., tar spot needle cast. Lake States.
Lentinus lepideus Fr., root & butt rot. Minn.
Lophodermium pinastri (Schrad. ex Fr.) Chev., needle cast. Lake States.
Polyporus circinatus Fr. and P. schweinitzii Fr., root & butt rot, heartwood rot. General.
* Rhizina undulata Fr., seedling blight. Minn.
Valsa superficialis Nit., branch canker. Mich.

(PINUS BRACHYPTERA): P. PONDEROSA SCOPULORUM.
PINUS CARIBAEA, See P. PALUSTRIS.
PINUS CEMBRA, See P. STROBUS.

PINUS CEMBROIDES Zucc., PIÑON, NUT PINE. A group of small to large trees including several varieties which are often given species rank. In the U. S., the name PIÑON is commonly applied to P. EDULIS Engelm. (= P. cembroides var. edulis Voss) of Growth Regions 9, 11, 13, 14, 16, 17, and MEXICAN PIÑON to P. CEMBROIDES in the southern part of this range. P. MONOPHYLLA Torr. & Frem., SINGLELEAF PIÑON, of G. R.'s 4, 5, 9, 10, 13, 14 and P. PARRYANA Engelm., PARRY PIÑON of G.R.'s 5 & 10, also are included.

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* Commonly cited in pathological literature as R. inflata (Schaeff.) Karst.

PINUS -- continued.

Arceuthobium campylopodum Engelm. forma divaricatum, dwarf mistletoe. Colo. and Utah to Calif. and N. Mex.
Coleosporium crowellii Cummins, needle rust. (III). Ariz., Colo., N. Mex.
C. jonesii (Pk.) Arth., needle rust (0,I). Ariz., Colo., Idaho, N. Mex., Utah.
Cronartium occidentale Hedgc., Bethel & Hunt, piñon blister rust. Central Rocky Mts. to Calif. and N. Mex.
Elytroderma deformans (Weir) Darker, needle cast, witches'-broom. Ariz., Colo.
Fomes pini (Brot. ex Fr.) Karst. and F. pinicola (Sw. ex Fr.) Cke. butt and heartwood rot. General.
Hypoderma pini (Dearn.) Darker, needle cast. Calif., Nev.
H. saccatum Darker, Colo., N. Mex.
Polyporus schweinitzii Fr., root & butt rot. General.

(PINUS CHIHUAHUANA): P. LEIOPHYLLA
PINUS CLAUSA, See P. VIRGINIANA

PINUS CONTORTA Loud., SHORE PINE. Tree of Growth Region 1. Including the somewhat related pines of the Pacific Coast P. ATTENUATA Lemm., KNOB-CONE pine of Growth Regions 4 and 10, and P. MURICATA D. Don, BISHOP PINE, and P. RADIATA Don, MONTEREY PINE of Growth Regions 1 & 5. The lodgepole pine, P. contorta var. latifolia is listed separately because of its wider range.

Arceuthobium americanum Nutt., dwarf mistletoe. Calif., Oregon.
A. campylopodum Engelm. forma typicum Gill, dwarf mistletoe. Ariz., Calif., Oregon.
Armillaria mellea Vahl ex Fr., root rot. Calif.
Bifusella linearis (Pk.) Höhn., needle cast. Colo.
Cenangium ferruginosum Fr., on twigs. Colo. to Mont. & Wash.
C. alpinum Ell. & Ev., Colo.
Coleosporium solidaginis (Schw.) Thuem., needle rust (0,I), Western form, sometimes distinguished from the Eastern form and known in the aecial stage as Peridermium montanum Arth. & Kern. Calif.
C. madiae Cke., needle rust (0,I). Calif. On P. radiata.
Coryneum cinereum Dearn., on old needles. Oregon.
Cronartium coleosporioides (Diet. & Holw.) Arth., including C. filamentosum (Pk.) Hedgc. and P. stalactiforme Arth. & Kern, lodgepole pine blister rust (0,I). Calif. to Alaska. Cf. Peridermium cerebroides.
C. comandrae Pk., Comandra blister rust (0,I). Oregon.
C. comptoniae Arth., sweetfern blister rust (0,I). Calif., Wash.
C. harknessii Meinecke, Western gall rust. (0 rarely, I). Calif.
(Although reported on various Coastal pines in Calif. and capable of infecting them by artificial inoculations, the naturally occurring

PINUS -- continued.

rust galls on the Coast pines are probably due to Peridermium cerebroides Meinecke = ? C. coleosporioides (Diet. & Holw.) Arth.)

C. quercuum (Berk.) Miyabe. Reports of this rust on Pacific Coast pines are doubtful and may pertain to the aecial stage of other Cronartium spp.; it occurs, however, on Quercus spp. inAriz. and Calif.

Elytroderma deformans (Weir) Darker, needle cast. Calif., Oregon.

Fomes annosus (Fr.) Cke.; F. officinalis (Vill. ex Fr.) Faull; F. pini (Brot. ex Fr.) Karst.; F. pinicola (Sw. ex Fr.) Cke.; F. roseus (Alb. & Schw. ex Fr.) Cke; and F. subroseus (Weir) Overh., butt & heartwood rot. General.

Hypoderma pedatum Darker, needle cast. Calif. On P. radiata.

Hypodermella spp., needle cast. H. cerina Darker, Calif.; H. lacrimiformis Darker, Calif. & Oregon, on P. attenuata; H. limitata Darker, and H. montivaga (Petr.) Dearn., Calif., on P. radiata.

Lophodermium nitens Darker, needle cast. Calif. On P. radiata.

L. pinastri (Schrad. ex Fr.) Chev., needle cast. Calif. to Alaska.

Naemacyclus niveus (Pers. ex Fr.) Sacc., needle cast. Calif.

Neopeckia coulteri (Pk.) Sacc., brown felt blight. Calif.

Peridermium cerebroides Meinecke, rust gall (O rarely, I). Calif. On P. attenuata and P. radiata.

Polyporus schweinitzii Fr., root and butt rot. General.

Rhizina undulata Fr., seedling blight, Calif.

Systremma acicola (Dearn.) Wolf & Barbour, brown spot of needles. Oregon. On P. attenuata.

PINUS CONTORTA Loud. var. LATIFOLIA S. Wats. (P. murrayana Balf.), LODGEPOLE PINE. Tree of Growth Regions 2, 4, 10, 12, 13, 14, 15.

Arceuthobium americanum Nutt., dwarf mistletoe. Rocky Mt. States, Pacific N. W.

A. campylopodum Engelm. forma typicum Gill, dwarf mistletoe.

Armillaria mellea Vahl ex Fr., root rot. Idaho.

Atropellis pinicola Zeller & Goodding, branch canker. Oregon.

A. piniphila (Weir) Lohman & Cash. Idaho, Mont., Wash.

Bifusella linearis (Pk.) Höhn., needle cast. Colo.

Cenangium ferruginosum Fr., on twigs. Colo. to Mont. and Wash.

C. alpinum Ell. & Ev., Colo.

C. purpureum (Hedw.) Sacc., Idaho.

Coleosporium sp., needle rust (O,I). Idaho, Mont., Wash. (Connection with C. occidentale Arth. (II,III) on Senecio indicated but not proved.)

C. solidaginis (Schw.) Thuem., needle rust (O,I), Western form, Peridermium montanum Arth. Colo. to Mont. and Wash. Also in N. J. and N. Car. on cult. specimens.

PINUS -- continued.

C. vernoniae Berk. & Curt., needle rust (O,I). Kans., N. Car. (cult.)
Coryneum cinereum Dearn., on senescent needles. Colo.
Cronartium coleosporioides (Diet. & Holw.) Arth. (including C. filamentosum Hedgc. and C. stalactiforme Arth. & Kern), lodgepole pine blister rust (O,I), Western fusiform rust, hip canker. Widespread.
C. comandrae Pk., Comandra blister rust (O,I). Colo. to Mont. and Idaho.
C. comptoniae Arth., sweetfern blister rust (O,I). Calif., also N.E.States (cult.).
C. harknessii Meinecke, Western gall rust, witches'-broom (O rarely,I). N. Rocky Mts. to Calif. and Wash.
Elytroderma deformans (Weir) Darker, needle cast. Mont. to Oregon.
Fomes annosus (Fr.) Cke., F. officinalis (Vill. ex Fr.) Faull, F. pini (Brot. ex Fr.) Karst., F. pinicola (Sw.ex Fr.) Cke., F. roseus (Alb. & Schw. ex Fr.) Cke., and F. subroseus (Weir) Overh., butt and heartwood rot. General.
Herpotrichia nigra Hartig, brown felt blight. N. Rocky Mts.
Hypodermella spp., needle cast. H. concolor (Dearn.) Darker, Colo. to Mont. and Oregon; H. medusa Darker, Colo.; H. montana Darker, Calif. to Idaho and Oregon; H. montivaga (Petr.) Dearn., Colo. to Mont. and Oregon.
Lentinus lepideus Fr., wood rot, sometimes of living trees. Ariz.
Lophodermium pinastri (Schrad. ex Fr.) Chev., needle cast. N. Rocky Mts., Ohio (cult.)
Naemacyclus niveus (Pers. ex Fr.) Sacc., needle cast. Mont. to Utah and Wash.
Neofuckelia pinicola Zeller & Goodding, on branches. Associated with Atropellis cankers. Oregon.
Neopeckia coulteri (Pk.) Sacc., brown felt blight. N. Rocky Mts. to Oregon & Wash.
Peridermium weirii Arth., needle rust (O,I). Idaho.
Polyporus schweinitzii Fr., root & butt rot. General.
Rhizina undulata Fr., seedling blight. N. Rocky Mts.
Stilbospora pinicola Berk. & Curt., needle blight. Oregon.
Systremma acicola (Dearn.) Wolf & Barbour, brown spot of needles. Ohio (cult.).

PINUS COULTERI, See P. SABINIANA.
PINUS DENSIFLORA. See P. RESINOSA.

PINUS ECHINATA Mill., SHORTLEAF PINE. Tree of Growth Regions 20, 25, 27, 28, 29, 30. Including P. GLABRA Walt., SPRUCE PINE, of G.R. 29 and 30; and P. TAEDA L., LOBLOLLY PINE, of G. R. 19, 20, 22, 25, 28, 29, 30. Hard pines of intermediate needle length and prevailingly southern range but reaching Long Island and the central Mississippi Valley.

Atropellis piniphila (Weir) Lohman & Cash, canker. Ala. On P. taeda.

PINUS -- continued.

A. tingens Lohman & Cash, twig and branch canker. Va. to Ala.
Cenangium ferruginosum Fr., on twigs. Ala., Ga.
C. atropurpureum Cash & Davidson, on dead twigs. Ga.
Ceratostomella pini Münch, blue stain and tracheomycosis. Southern States.
Coleosporium apocynaceum Cke., needle rust (O,I). Fla. on P. taeda.
C. delicatulum Hedgc. & Long, needle rust (O,I) Pa. to Fla. and Texas.
C. elephantopodis (Schw.) Thuem., needle rust (O,I). Va. to Fla., Texas and Mo.
C. helianthi (Schw.) Arth., needle rust (O,I). Ga., N.Car.
C. inconspicuum Hedgc. & Long, needle rust (O,I). Md. to Ala.
C. ipomoeae (Schw.) Burr., needle rust (O,I). Pa. to Fla., Texas and Mo.
C. laciniariae Arth., needle rust (O,I). N.J., Fla. On P. taeda.
C. minutum Hedgc. & Hunt, needle rust (O,I). Fla. On P. glabra and P. taeda.
C. pinicola Arth., needle rust (III). Md.
C. solidaginis (Schw.) Thuem., needle rust (O,I). N.J. to Ala. and Ark.
C. terebinthinaceae (Schw.) Arth., needle rust (O,I). Pa. to Ala. and Ark.
C. vernoniae Berk. & Curt. (C. carneum Jacks.), needle rust (O,I). Md. to Fla., Texas and Kansas.
Cronartium comptoniae Arth., sweetfern blister rust (O,I). N.J. to Ga. and Mich.
C. fusiforme Hedgc. & Long, Southern fusiform rust (O,I). Southern States. (Resistant).
C. quercuum (Berk.) Miyabe, Eastern gall rust (O,I). Va. to Fla. and Ark.
Dacryomyces sp., sapwood stain and tracheomycosis. N.Car.
Diplodia megalospora Berk. & Curt., on branches and roots, ? canker, ? wood stain. Gulf States.
D. natalensis Pole-Evans, blue wood stain. Gulf States.
Elytroderma deformans (Weir) Darker, needle cast. Ga.
Fomes annosus (Fr.) Cke., F. pini (Brot. ex Fr.) Karst., F. pinicola (Sw. ex Fr.) Cke., butt and heartwood rot. Widespread.
Geotrichum sp., pink wood stain. Southern States.
Hypoderma hedgcockii Dearn., needle cast. Miss., N.Car., Va.
H. lethale Dearn., needle cast, gray needle blight. Va. to Fla., La.
Irenina (Melicla) pinicola (Dearn.) F.L.Stevens, black mildew. N.Car.
Lophodermium pinastri (Schrad. ex Fr.) Chev., needle cast. Md. to La. and Ark.
Pezizella minuta Dearn., on needles. Ga., N. Car.
Polyporus schweinitzii Fr., and P. sulphureus Bull. ex Fr., root & butt rot. Occasional.
Rhizopogon parasiticus Coker & Totten, parasitic ectotrophic mycorhiza. N.Car.

PINUS -- continued.

C. vernoniae Berk. & Curt., needle rust (O,I). Kans., N. Car. (cult.)
Coryneum cinereum Dearn., on senescent needles. Colo.
Cronartium coleosporioides (Diet. & Holw.) Arth. (including C. filamentosum Hedgc. and C. stalactiforme Arth. & Kern), lodgepole pine blister rust (O,I), Western fusiform rust, hip canker. Widespread.
C. comandrae Pk., Comandra blister rust (O,I). Colo. to Mont. and Idaho.
C. comptoniae Arth., sweetfern blister rust (O,I). Calif., also N.E.States (cult.).
C. harknessii Meinecke, Western gall rust, witches'-broom (O rarely,I). N. Rocky Mts. to Calif. and Wash.
Elytroderma deformans (Weir) Darker, needle cast. Mont. to Oregon.
Fomes annosus (Fr.) Cke., F. officinalis (Vill. ex Fr.) Faull, F. pini (Brot. ex Fr.) Karst., F. pinicola (Sw.ex Fr.) Cke., F. roseus (Alb. & Schw. ex Fr.) Cke., and F. subroseus (Weir) Overh., butt and heartwood rot. General.
Herpotrichia nigra Hartig, brown felt blight. N. Rocky Mts.
Hypodermella spp., needle cast. H. concolor (Dearn.) Darker, Colo. to Mont. and Oregon; H. medusa Darker, Colo.; H. montana Darker, Calif. to Idaho and Oregon; H. montivaga (Petr.) Dearn., Colo. to Mont. and Oregon.
Lentinus lepideus Fr., wood rot, sometimes of living trees. Ariz.
Lophodermium pinastri (Schrad. ex Fr.) Chev., needle cast. N. Rocky Mts., Ohio (cult.)
Naemacyclus niveus (Pers. ex Fr.) Sacc., needle cast. Mont. to Utah and Wash.
Neofuckelia pinicola Zeller & Goodding, on branches. Associated with Atropellis cankers. Oregon.
Neopeckia coulteri (Pk.) Sacc., brown felt blight. N. Rocky Mts. to Oregon & Wash.
Peridermium weirii Arth., needle rust (O,I). Idaho.
Polyporus schweinitzii Fr., root & butt rot. General.
Rhizina undulata Fr., seedling blight. N. Rocky Mts.
Stilbospora pinicola Berk. & Curt., needle blight. Oregon.
Systremma acicola (Dearn.) Wolf & Barbour, brown spot of needles. Ohio (cult.).

PINUS COULTERI, See P. SABINIANA.
PINUS DENSIFLORA. See P. RESINOSA.

PINUS ECHINATA Mill., SHORTLEAF PINE. Tree of Growth Regions 20, 25, 27, 28, 29, 30. Including P. GLABRA Walt., SPRUCE PINE, of G.R. 29 and 30; and P. TAEDA L., LOBLOLLY PINE, of G. R. 19, 20, 22, 25, 28, 29, 30. Hard pines of intermediate needle length and prevailingly southern range but reaching Long Island and the central Mississippi Valley.

Atropellis piniphila (Weir) Lohman & Cash, canker. Ala. On P. taeda.

PINUS -- continued.

A. tingens Lohman & Cash, twig and branch canker. Va. to Ala.
Cenangium ferruginosum Fr., on twigs. Ala., Ga.
C. atropurpureum Cash & Davidson, on dead twigs. Ga.
Ceratostomella pini Münch, blue stain and tracheomycosis. Southern States.
Coleosporium apocynaceum Cke., needle rust (O,I). Fla. on P. taeda.
C. delicatulum Hedgc. & Long, needle rust (O,I) Pa. to Fla. and Texas.
C. elephantopodis (Schw.) Thuem., needle rust (O,I). Va. to Fla., Texas and Mo.
C. helianthi (Schw.) Arth., needle rust (O,I). Ga., N.Car.
C. inconspicuum Hedgc. & Long, needle rust (O,I). Md. to Ala.
C. ipomoeae (Schw.) Burr., needle rust (O,I). Pa. to Fla., Texas and Mo.
C. laciniariae Arth., needle rust (O,I). N.J., Fla. On P. taeda.
C. minutum Hedgc. & Hunt, needle rust (O,I). Fla. On P. glabra and P. taeda.
C. pinicola Arth., needle rust (III). Md.
C. solidaginis (Schw.) Thuem., needle rust (O,I). N.J. to Ala. and Ark.
C. terebinthinaceae (Schw.) Arth., needle rust (O,I). Pa. to Ala. and Ark.
C. vernoniae Berk. & Curt. (C. carneum Jacks.), needle rust (O,I). Md. to Fla., Texas and Kansas.
Cronartium comptoniae Arth., sweetfern blister rust (O,I). N.J. to Ga. and Mich.
C. fusiforme Hedgc. & Long, Southern fusiform rust (O,I). Southern States. (Resistant).
C. quercuum (Berk.) Miyabe, Eastern gall rust (O,I). Va. to Fla. and Ark.
Dacryomyces sp., sapwood stain and tracheomycosis. N.Car.
Diplodia megalospora Berk. & Curt., on branches and roots, ? canker, ? wood stain. Gulf States.
D. natalensis Pole-Evans, blue wood stain. Gulf States.
Elytroderma deformans (Weir) Darker, needle cast. Ga.
Fomes annosus (Fr.) Cke., F. pini (Brot. ex Fr.) Karst., F. pinicola (Sw. ex Fr.) Cke., butt and heartwood rot. Widespread.
Geotrichum sp., pink wood stain. Southern States.
Hypoderma hedgcockii Dearn., needle cast. Miss., N.Car., Va.
H. lethale Dearn., needle cast, gray needle blight. Va. to Fla., La.
Irenina (Melicla) pinicola (Dearn.) F.L.Stevens, black mildew. N.Car.
Lophodermium pinastri (Schrad. ex Fr.) Chev., needle cast. Md. to La. and Ark.
Pezizella minuta Dearn., on needles. Ga., N. Car.
Polyporus schweinitzii Fr., and P. sulphureus Bull. ex Fr., root & butt rot. Occasional.
Rhizopogon parasiticus Coker & Totten, parasitic ectotrophic mycorhiza. N.Car.

Systremma acicola (Dearn.) Wolf & Barbour, brown spot. N. Car. and Tenn. to Fla. and Texas.

Little leaf, -- cause unknown. S. E. States, Va. to Ala., also Texas.

DIVISION OF MYCOLOGY AND DISEASE SURVEY.

A WILT AND ROOT ROT OF ASPARAGUS CAUSED BY FUSARIUM OXYSPORUM SCHLECHT 1/

Sylvan I. Cohen and F. D. Heald

A wilt and root rot of asparagus has recently been observed in many of the irrigated, sandy soil regions of Washington. Investigations have proven a common soil-borne fungus, Fusarium oxysporum Schlecht., to be the causal agent of the disease. Numerous reports of a root, crown, and stem rot have been made from most of the large asparagus-growing areas of the United States in which an unidentified species of Fusarium has been associated with the disorder. In one instance the isolates from diseased crowns grown in South Carolina (8)2/ were identified by Dr. C. D. Sherbakoff as F. semitectum Berk. and Rav. and F. moniliforme Sheldon, but no pathogenicity studies with these species were made.

History and Geographic Distribution

Apparently the first report of a fusariosis of asparagus was made by Stone and Chapman in Massachusetts in 1908 (14). These authors observed a wilting of young shoots during the cutting season from which an unidentified species of Fusarium was isolated, accompanied by a stem rot (yellowing) of the mature stalks later on during the growing period. Cook (11), in 1923, mentioned the occurrence of an asparagus disease in New Jersey which he called "Dwarf Asparagus." Stunted, yellowed plants, showing vascular discolorations within the stems, were observed to occur in circular areas in many asparagus plantings. An unidentified Fusarium was always associated with such diseased crowns. It is the opinion of the writers that this disease is identical with the one under consideration, as the senior author has observed the condition in New Jersey during 1940. Since then, numerous reports of root and crown rots and wilts have been made from New York (1, 3, 10), New Jersey (1, 2, 4, 6, 7, 11), North Carolina (5), South Carolina (8), Pennsylvania (4), Illinois (1,4), Massachusetts (1, 2, 3, 6, 9, 14), Missouri (6,13), California (1,5), and Washington (5).

A somewhat similar footrot of asparagus has been reported from Germany since 1929 as affecting 60 to 80 percent of the extensive plantings near Dresden (15). Fusarium culmorum (W. G. Sm.) Sacc. was found to be the cause of the disease, but the description of the disorder in Europe as reported by Weise (17) was noted to be quite distinct from

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1/ Published as Scientific Paper No. 499, College of Agriculture and Agricultural Experiment Station, State College of Washington.

2/ The number in the parenthesis refers to Literature Cited, at end.

the one occurring in America. Although the shoots yellowed prematurely during the growing season, this symptom was due to a rot of the ground parenchyma tissues of the stem bases, leaving the vascular strands unaffected, whereas the wilt reported here primarily attacks the vascular bundles of the host without necessarily invading the ground parenchyma. It therefore seems apparent that these are distinct fusarioses of asparagus.

Economic Importance

In New York and Massachusetts, this disease has affected 5 to 10 percent of the plants in most of the asparagus plantings, and has been reported to be more destructive than rust (10). Surveys made in the State of Washington corroborate these estimates and reveal the presence of the disease in almost every asparagus field, although generally older plantings are more seriously affected than younger ones. In certain sandy-soil areas in the lower Yakima Valley, 25 to 50 percent of the crowns are diseased or dead, indicating the more serious aspects of this disorder.

Symptoms and Effects

In the field the disease is usually first noticed after the cutting period when the elongated stalks become yellow and die. Either one or two shoots of a crown may be affected, while the others remain normally green, or the entire hill may be dead. Such diseased plants are usually found scattered throughout the field, although they are more abundant on low areas and on steep sandy slopes. Upon closer examination the yellowed stalks are found to manifest a red or reddish-brown discoloration of the scattered vascular bundles at their bases. Often this discoloration occurs in distances varying up to 2 feet into the stalk, although it may be restricted to the basal regions. Depressions and cracks of the stem bases are commonly observed, and are believed to be caused by the shrinkage and collapse of the parenchyma tissues around the diseased vascular bundles. Under cool moist conditions which do not favor wilt development, the fungus initiates a red stem rot that may sever the shoot from the crown. The pathogen then commonly fruits upon the surfaces of the stems.

Shoots in the early stage of wilting usually exhibit a yellow streak spiraling upwards, and cladophylls arising from this yellowed area are yellowed also, whereas those originating in green stem areas are still green. In these instances the yellowed streaks can be correlated with partial discolorations of the vascular bundles of the stems.

When diseased plants are removed from the soil, they are observed to possess a strikingly large number of dried-out roots distributed over the old and new portions of the crown. Other roots show numerous red-brown, firm, elliptical lesions, and represent earlier stages of this root rot. By cutting the roots longitudinally, the red cortical areas are often seen to penetrate into the stele, where this same discoloration is observed to extend upwards and downwards in the root for as much as 12 inches. Often the red stelar discoloration originates at a point of injury and penetrates into the tissues of the rootstock, revealing a vascular connection with a

yellowed shoot. The "dried-out" storage roots represent a complete disintegration of the cortex, accomplished by secondary invaders, leaving only the discolored stele surrounded by an outer layer of suberized cork cells.

It is often possible to trace vascular discolorations down an injured or harvested shoot into the crown and then to note the spread of the pathogen in the rootstock to newly-formed meristematic regions. Apparently the fungus is able to infect the stem through injuries well above the soil line and then attack the entire crown.

During the cutting season, and also later on in the growing period, another symptom of the disorder may be observed. Young shoots varying in height from 6 inches to 2 feet suddenly wilt before developing their cladophylls. This condition is easily confused with frost injury or drought, according to the time of occurrence, but pathogenicity experiments under controlled conditions have demonstrated the ability of the fungus to produce this wilt in the absence of excessively high or low temperatures. It is apparent that the fungus initiates a symptomatological complex in the host. It may destroy the roots during early stages of root infection, thereby interfering with the water supply to the shoot, or the parasite may actually invade the vascular system of the root, crown, and shoot, producing a true tracheal mycosis and death of these organs.

Observations of young asparagus plantings reveal another phase of the disease. Slender, yellowed stems frequently possess elliptical, red-brown lesions that often girdle the shoot at the soil level. Incipient infections are distinguished by superficial red-discolored streaks in the white outer stem tissues. Microscopic examination has shown the fungus to be present in the cortical tissues of these organs, and even to have penetrated into the vascular bundles within these areas. In addition to the isolation of the Fusarium from such typical lesions, further proof of the parasitic relationship was obtained by transplanting seedlings into contaminated soil. In every instance characterisitc lesions developed upon the young succulent stems regardless of whether or not they had been injured.

As a result of infection, the aerial organs of the host are prematurely killed, thereby reducing the amount of food produced by the shoots during the growing period and later translocated to the roots for storage purposes. The buds differentiated for the next year's growth are dependent upon the food supply stored in the roots, and consequently are smaller, and produce shoots of little or no commercial value. Seriously diseased crowns are noted to produce stunted and prematurely yellowing shoots in subsequent years, until ultimately such crowns die out, reducing the productivity of a commercial planting. In a 5-year-old planting about 5 percent of the crowns were observed to die from year to year.

Etiology

At first the yellowing of mature shoots was believed to be due to 2 conditions: sunscald cankers formed at their bases, and asparagus miner injury. This seemed quite possible as most of the asparagus in Washington is grown on sandy soils in regions where the summer temperatures frequently

rise above 110°F. for extended periods of time. In addition, there were numerous puparia of the miner at the bases of affected shoots. The wilting of young spears during the cutting season was thought to be a distinct condition arising from frost injury, while the same condition later in the growing season appeared to be correlated with insufficient irrigation. However, careful field observations and pathogenicity studies have demonstrated that both these disorders are related to the wilt disease under investigation. As far as the miner injury is concerned, shoots have been observed in the field which were badly infested with the miner, yet remained green, whereas stalks containing relatively few puparia appeared brilliantly yellow.

Isolations from the vascular bundles of roots, crowns, and shoots have revealed the presence of Fusarium oxysporum in pure culture. Monoconidial lines of this same Fusarium have proved its ability to produce all of the above symptoms in pathogenicity studies in the greenhouse at temperatures of 20-29° C. in Palouse silt loam, although the optimum temperature of the fungus in pure culture is 27° C. When sandy soils were employed, the incubation period was reduced, and typical symptoms appeared more rapidly. Crowns 2 and 3 years old have proved equally susceptible to infection, and it has been shown that the fungus can penetrate uninjured tissues as readily as injured ones. Temperature appears to be the most important environmental factor governing infection. Experiments conducted during periods of high temperatures gave higher percentages of diseased plants than did those carried out during cool, cloudy weather.

The nature of the asparagus plant and its culture are very conducive to infection. The host is a perennial monocotyledon with underground rootstock that differentiates root and stem meristems at its apices. As the current year's organs die, the fungus can readily penetrate these structures and live saprophytically during the cold winter and spring. Then, during the warm periods of summer, the fungus can vigorously attack the living portions of the host, producing the symptoms described. The method of harvesting asparagus spears during the cutting season by cutting them off beneath the soil level offers the pathogen another avenue of infection. Disking and cultivating asparagus beds after the cutting season frequently injures the crowns and young shoots, and furthers the possibilities of parasitic invasion.

During the course of the pathogenicity studies it was observed that all field-grown crowns in this region were already contaminated by the Fusarium. In an attempt to obtain disease-free stock the writer secured supposedly healthy 5-year-old crowns from South Carolina and California.3/ However, isolations from suspicious-looking discolorations in these organs preliminary to using them in experiments established the fact that they already contained F. oxysporum. Employing these isolates as inocula revealed that they could produce typical symptoms of yellowing and wilt. Apparently, therefore, the disease is omnipresent wherever asparagus is grown in America.

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3/ The authors wish to express their appreciation to Dr. G. M. Armstrong of South Carolina, and Dr. T. W. Whitaker of California, for sending the asparagus crowns employed in this part of the investigation.

The strain of Fusarium oxysporum from asparagus appears to differ in its pathogenicity from varieties already described. It does not attack potatoes (White Rose and Gem), tomatoes, or carnation (Joan Marie), at 20-22°C. It proved unable to rot potato tubers or onion bulbs maintained at 25°C. in a moist chamber. Apparently the fungus vigorously infects only asparagus, and causes a slight wilt of Alaska peas that resembles "near wilt" symptomatologically. All of the commercial varieties of asparagus appear to be equally susceptible, and the ornamental Asparagus plumosus Baker has been observed to be infected under greenhouse conditions.

During August of 1941, 2 instances of seedling wilt were reported from widely different regions. An asparagus nursery established upon a fine sandy loam in Sunnyside, Washington, which had previously been cropped to sweet corn, was seriously affected by a yellowing and death of many of the seedlings. The roots were typically collapsed and possessed reddish-brown lesions, as did the stem bases. Isolations from these organs yielded the fungus, and a pure monoconidial culture produced the same symptoms upon seedlings grown in artificially contaminated soil. This constituted the first confirmation of the seedling wilt as occurring under natural field conditions, although this phase of the disease had been observed under experimental conditions in the greenhouse. The other report was made by Dr. W. C. Snyder from an asparagus nursery in central California, and the symptoms were identical to those observed in Washington.

Histological studies of infected roots, stems, and crowns revealed the presence of typical hyphae of the Fusarium in the vascular tissues of these organs; namely, the tracheae, xylem parenchyma, phloem, and even the cortical parenchyma cells. A necrosis of parenchyma cells far in advance of the fungous hyphae in the cortex, as well as of those tissues surrounding vessels that contained the fungus, indicated the presence of a toxic secretion which has already been reported for this species by Goss (12) and Wardlaw (16) in connection with potato and banana wilts respectively. A brown granular occlusion of the lumen of vessels was always associated with the tracheal mycosis, and constituted the vascular discoloration already noted.

Control

Observations of field plots for testing fertilizers, established by the Department of Horticulture of the Washington Agricultural Station in the Yakima Valley, revealed that treatments of sandy loam and clay soils with 1000 lbs. per acre of marl, 1750 lbs. per acre of ammonium sulfate, 16 tons of alfalfa, 15 tons of manure, and liberal additions of potash and phosphorus respectively, had no significant effect upon the severity of the disease. Furthermore, soils varying in pH from 6 to 8.4 produced the same percentages of infected plants, indicating that fertilizer treatments and attempts to adjust the soil acidity would probably offer no solution to the problem of disease control.

At present, investigations are in progress to obtain the only real control for this disease; i.e., a search for the existence of naturally resistant species or strains of asparagus which may permit the initiation of a hybridization program.

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BACTERIAL RING ROT OF POTATOES IN ILLINOIS

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This account of bacterial ring rot of potatoes, caused by Phytomonas sepedonica (Spieckermann) Magrou (1,2) in Illinois is recorded because of the lack of any previous report of the disease in the State and because of the increasing importance of this disease in the United States and Canada. Potato tubers of the Cobbler variety with unquestionable symptoms (creamy, yellow, and light brown necrosis of the vascular areas) were observed at Belleville, Illinois in the St. Louis area August 20. Microscopical examination of the tissues at the junction of the discolored injured areas and healthy tissues showed abundance of bacteria. Plate isolations on dextrose-broth agar from these areas gave yellowish-white colonies. Bacteria from tissues and from isolated cultures were gram positive. From this evidence and without reinoculations and reisolations, the disease was concluded to be bacterial ring rot. The seed used for this planting was from home-grown potatoes of this area last year. Additional diseased tubers were observed at Quincy, Illinois on October 1.

Workers have not been consistent in the use of the scientific name of this pathogen and the common name of the disease. The following may be of value in these respects. In Bergey's Manual of Determinative Bacteriology (1), the system of nomenclature generally used in phytopathological literature, the above name is used. P. sepedonica (Spieckermann and Kolthoff) Bergey et al. sometimes found in the literature appears to be incorrect for three reasons: (a) Spieckermann (4) in 1913 and not Spieckermann and Kolthoff (5) in 1914, first published the name Bacterium sepedonicum for this organism; (b) P. sepedonica (Spieckermann) Magrou (2)

and not P. sepedonica (Spieckermann and Kolthoff) Bergey et al. is given in Bergey's Manual (1); (c) Magrou (2) in 1937 and not Bergey et al. (1) gave the name P. sepedonica. The complete scientific name is as follows: Phytomonas sepedonica (Spieckermann) Magrou, 1937 (2). Synonyms: Bacterium sepedonicum, Spieckermann, 1913 (4). Aplanobacter sepedonicum, (Spieckermann) E. F. Smith, 1920 (3, p.207). "Bacterial ring rot" appears to be more generally used and more specific than "bacterial wilt and soft rot." The latter name may cause confusion with 2 other bacterial diseases of potatoes. In view of this and the desirability of using standard common names for plant diseases "potato bacterial ring rot" is suggested for general usage.

Considerable difficulty was encountered in obtaining Spieckermann's paper (3) owing to the system of cataloging periodicals of not listing the journal as its name is given in some references (Landwirtschaftliche Zeitung). Catalogs and indexes list this journal under both of the titles given in reference 3 which may be of aid to anyone desiring to obtain this paper.

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ROOT-KNOT NEMATODE IN PARTS OF WEST TENNESSEE

James M. Epps and L. A. Fister

In August 1941 the authors made a brief survey of the occurrence of root-knot nematodes [Heterodera marioni] in certain areas of West Tennessee, primarily in the trucking sections. The following is a brief report of results. Places where inspections were made are shown on the map (Fig. 1) by figures corresponding to those in the text.

North, south, and west of Covington (1), Tipton County: Tomatoes, pole lima beans, snap beans, field peas, soybeans, cotton, corn, and a variety of weeds were examined in gardens and fields and found to be free from root knot.

North, west, and east of Dyersburg (2), Dyer County: Tomatoes, pole lima beans, snap beans, soybeans, watermelons, and cotton were examined. No root knot was found.

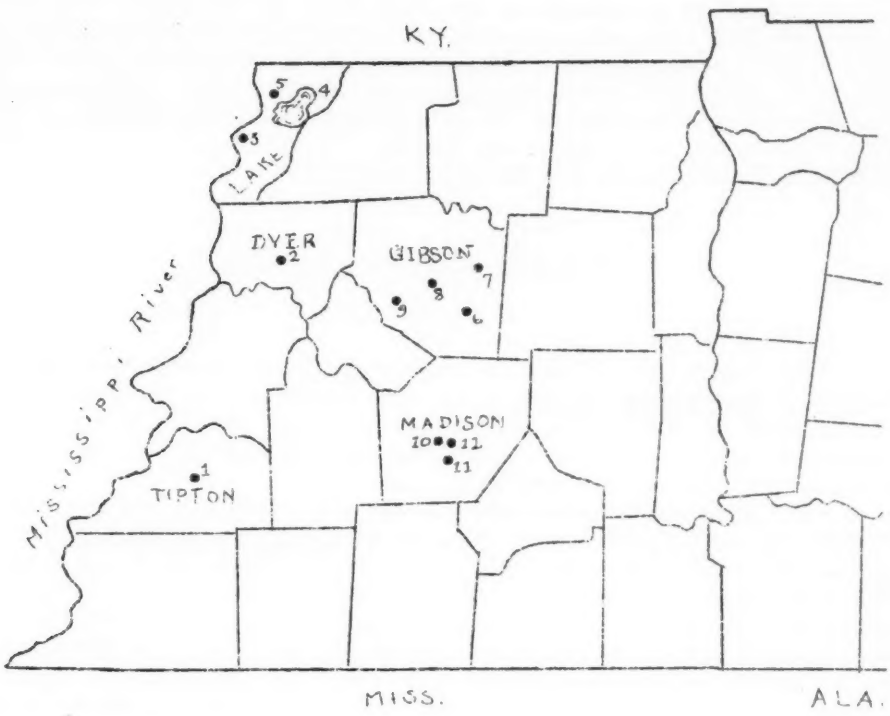

Figure 1. Locations in western Tennessee where the root-knot survey was made. The figures in the map are the same as those used in the text.

East of Ridgely (3), north and south of Reelfoot Lake (4), and south of Tiptonville (5), Lake County: Extensive root-knot damage was found on tomatoes and field peas. In this area on sandy soil several fields of cotton and soybeans were found badly affected.

Areas around Medina (6), Milan (7), Gibson (8), and Humboldt (9), Gibson County: Eight tomato fields were examined, and only one, 1-1/2 miles east of Humboldt, was found with root knot.

In Madison County: Private gardens of workers at West Tennessee Experiment Station (10) were gone over carefully and 3 were found with root knot, 2 were free from it. The infected crops included cowpeas, corn, okra, cabbage, tomatoes, watermelons, and snap beans. Gardens of textile workers in the town of Bemis (11) were examined. All new gardens, up to 4 years old, were free from root knot, while 3 old gardens showed it on okra, tomatoes, snap beans, cabbage, beets, Crowder's peas, pole beans, bush lima beans, sweet peppers, and corn. In Jackson (12) an old garden was examined and found with root-knot damage on sunflowers, tomatoes, and roses. A nearby farm garden showed root-knot nematodes on snap beans, carrots, tomatoes, and okra.

Attention is called to the fact that in the Bemis inspection it was noted that root knot was present only in the older gardens. Snap and lima beans, tomatoes, okra, cabbage, sweet pepper, stock peas, and corn were most seriously affected. Eggplant, hot peppers, sweet potatoes, and gladiolus were not affected in any gardens examined. The most serious damage was noted on light sandy soils.

TENNESSEE AGRICULTURAL EXPERIMENT STATION.

GRAY SPOT OF TOMATOES IN TEXAS

A.L. Harrison

In August 1941 a leaf spot answering the description of gray spot caused by Stemphylium solani Weber was found on some tomatoes growing in a lath house at the Tomato Disease Laboratory, Yoakum, Texas. The disease developed rapidly and caused considerable defoliation in spite of the fact that the weather was hot and dry.

On microscopic examination spores of Stemphylium were found that answered the published description of Stemphylium solani Weber. Specimens of the leaf spot were sent to Dr. G. F. Weber of Florida, who confirmed the writer's diagnosis of the trouble. As far as the writer is aware, this is the first record of gray spot west of the Mississippi. Andrus has recently added Louisiana, North Carolina, Virginia, and Tennessee to the known distribution of gray spot (PDR 25:445-446. 1941). It appears from the present report and from the report by Andrus that gray spot is spreading rapidly over the Southern United States, and may soon constitute a major problem in some of the other tomato sections of the country.

TOMATO DISEASE LABORATORY, TEXAS AGRICULTURAL EXPERIMENT STATION, YOAKUM, TEXAS.

STRAWBERRY DISEASES IN OREGON IN 1941

S. M. Zeller

Since the discovery of the red-core root-rot [1/] of strawberries in Oregon in 1937, the disease has spread rapidly. It is now found in nearly every county in the Willamette Valley, especially in districts where strawberries are produced commercially. It seems probable that the disease was brought into the State on varieties of recent origin, such as Dorsett, Fairfax, Narcissa, and Redheart. Marshall, Corvallis, Ettersburg #121, Improved Clark, and Redheart, all of which are grown to a greater or less extent in the State, are susceptible. The disease is most severe in heavy or poorly drained soils. It usually has not been found to do as heavy damage in locations where black root caused by Rhizoctonia has been known to cause most serious damage. Some members of the Extension Service believe the red-core disease is more destructive than all

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[1/ NOTE: The organism causing the disease has been described as Phytophthora fragariae. (Hickman, C. J. The red core root disease of the strawberry caused by Phytophthora fragariae n. sp. Journ. Pomol. and Hort. Sci. 18:89-118. 1940.)]

of the other strawberry diseases we have, including virus diseases.

The virus-disease situation in western Oregon is becoming very serious. Whereas a very few years ago strawberry yellows [Xanthosis] was practically unknown in the Willamette Valley, large infection areas are now to be found, especially in districts where planting stock harboring the disease has been brought in. The year after infection the plants are worthless, and must be rogued or, if high percentages prevail, plowed out the second year. The crinkle disease is serious enough but usually when this is the only virus present the second or third crop may pay. When double infections occur the yellows symptoms are dominant, crinkle mostly disappearing. For this reason in areas where both diseases exist, growers are prone to believe that crinkle is merely an early stage of yellows. On the other hand, there are districts where only crinkle occurs and persists without any indication of yellows ever showing.

The most serious persistence and spread of these virus diseases occur in areas where native forest stumpage or pasture lands abound with the wild field strawberry (Fragaria cuneifolia).

The virus diseases known as witches'-broom and stunt are very much less serious than yellows and crinkle in recent years. Witches'-broom has been all but eradicated by roguing and stunt may follow the same course.

Our program over the past several years of systematic improvement of strawberry planting stock through certification has enabled growers to keep abreast at least of crinkle and yellows in some districts and in others to cut these diseases down enough to practically double the acre yield of strawberries within a 5-year period.

Leaf spot, mildew, scorch, and leaf blight [Mycosphaerella fragariae, Sphaerotheca humuli, Diplocarpon earliana, Dendrophoma obscurans], although present, are not serious enough to warrant systematic attempts at control. In some districts mildew has been controlled by use of sulfur dust, especially where Clark Seedling or Improved Clark are grown.

OREGON AGRICULTURAL EXPERIMENT STATION.

SOME DISEASES OF BELLADONNA IN CALIFORNIA AND THEIR CONTROL

John T. Middleton

With the rapidly increasing interest shown in the cultivation of pharmaceutical crops a variety of interesting diseases are encountered. A number of diseases of belladonna, Atropa belladonna, were recently reported by MacMillan in the Plant Disease Reporter 25:443-445; 3 additional items may be added at this time.

A disease, caused by Phytophthora parasitica, affecting the roots, crown, and stems of belladonna grown near Camarillo, California, occurs in hillside plantings on heavy, poorly drained soils. Plantings made on well drained soils are relatively free of the disease. The fleshy roots turn dark brown to black in color, become watersoaked and later flaccid. Root infection progresses upward infecting other roots and often the crowns. Plants with naturally infected roots infrequently recover; plants

with naturally infected crowns invariably die. Often the root infection progresses up into the stem, failing to kill the crown completely. Conspicuous dark, discolored, slightly sunken areas are produced on infected stems. Under suitable environmental conditions, i.e., moderate to high temperatures and high relative humidity, the disease may infect the basal leaves.

Through leaf and stem infections the disease may spread throughout the planting. Infection of aerial parts of the plant is sustained and accelerated through the use of an over-head irrigation system. The incidence of the disease may be substantially reduced through abolishment of this type of irrigation system and the use of 2-2-50 bordeaux spray with a suitable wetting agent.

The pathogenicity of Phytophthora parasitica to belladonna plants has been proved in controlled inoculation experiments.

Damping-off of belladonna seedlings and cuttings in the propagation bench is largely caused by Pythium ultimum, though two other species, P. debaryanum and P. irregulare, are also concerned. The pathogenicity of these fungi to belladonna has been established by inoculation. Sterilization of propagation flats and soil by means of chloropicrin have produced excellent results.

Another propagation disease previously reported (PDR 25:444-445) is psyllid yellows, caused by the insect Paratrioza cockerelli. This disease was serious only in one lath house subsequent to the removal of the young plants from the greenhouse. Several plants were infected in the field but the disease failed to spread and was of no importance. Psyllid yellows was controlled by liquid spray applications of nicotine sulphate or derris in conjunction with emulsifier B1956. In the absence of the wetting agent no satisfactory control was obtained.

Downy mildew of belladonna, reportedly caused by Peronospora hyoscyami (P.D.R. 25:443-444), occurred in the field plantings as well as in the propagation houses. This disease seriously threatened the 1941 plantings of belladonna in southern California. Satisfactory control was secured by a thorough application of 0.5 per cent lime sulfur and 0.05 percent B1956 emulsifier; control was also effected by application of 2-2-50 bordeaux and emulsifier, but the results were not as satisfactory as those from the lime sulfur treatment. Field applications of lime sulfur would necessitate approximately 250 to 300 gallons per acre.

Three foliar diseases have been observed on belladonna grown in Ventura County, California; though some defoliation occurred, under existing conditions the diseases were apparently of no economic importance. The fungi are an unidentified species of Macrosporium, closely resembling M. [Alternaria] solani, Ramularia sp., and Mycosphaerella sp.

CALIFORNIA CITRUS EXPERIMENT STATION, RIVERSIDE.

TOBACCO DISEASES IN MASSACHUSETTS IN 1941

O. C. Boyd

Unusual Season for Plant Growth and for Field Setting. -- With an abnormally warm, dry April, the growing season opened from 10 to 14 days early. Frost was shallow and came out of the ground early, allowing

unusually early preparation and seeding of beds. May, too, was below normal in rainfall, although the mean temperature was only slightly above normal. Owing to the shortage of soil moisture generally, many growers found it difficult to keep the beds supplied with water, particularly during the abnormally warm period of April 14 to 20 when the maximum daily temperatures (at Amherst) ranged between 74° to 90°F. The stand of plants was unusually spotty in many beds, and the growers were inclined to attribute this condition to the difficulty in keeping the beds moist during germination, and to the injurious effect on the seedlings of the abnormally high temperatures.

Plant growth generally was rapid and field setting began unusually early, generally around May 20-24. In fact, some growers finished their original planting by the first of June. However, additional difficulties were encountered. Owing to the dry condition of the soil during late May and early June, and particularly to the high winds of June 8 to 11, much stocking-over was necessary, as well as resetting outright of entire fields or large areas of fields. In spite of these early season difficulties, growing conditions for the latter half of June and during the remainder of the season were favorable for tobacco. As a result, a fair-to-heavy yield of good quality tobacco generally was harvested.

The Disease Situation.-- Nothing striking occurred this year in the way of diseases, unless we consider the general scarcity of such field diseases as wildfire and angular leaf spot. Not a single case of wildfire was observed in the bed, and only one in the field. The latter involved a comparatively heavy infection on a farm in Southwick. The grower stated he first observed the disease in the field about four weeks prior to harvest, and that the disease was present in all fields set from his beds.

Angular leaf spot [Phytomonas angulata] was not encountered so frequently nor in such heavy infections in the beds this year as in most past seasons. The spots were restricted almost altogether to the lowermost leaves. Furthermore, no more than a mere trace was observed in any field, and those very light infections were located on the bottom leaves.

Mosaic [virus], although about normal for general distribution and amount of damage, was very irregular in behavior. It was almost entirely absent on some farms, particularly in the earliest plantings, and very prevalent and damaging on others, particularly in the latest plantings. One striking case involved a late setting on a seed-bed site in which the plants, rather small at the time, were badly lodged by a storm during the last week of July. Practically every plant had to be straightened up, according to the grower, and about 90 percent of them showed the "rust" stage of mosaic shortly before harvest. Probably 2 factors operated to account for the heavy infection: The location, i.e., on the bed site, and the handling that the plants received following the storm. As in most past years, mosaic caused more loss to the crop than any other single disease; and this year, it caused more damage to the crop in the field than all other diseases combined.

In spite of the dry spring season, damping-off and bed rot were as prevalent in the beds this year as in past seasons. In fact, it is believed that these diseases were present in more beds than in most past seasons. This is not surprising since it was necessary to water the

beds this year more frequently and more heavily than in moister seasons. Neither the early season damping-off nor the later occurring bed rot was observed to cause appreciable damage in beds dusted or sprayed regularly as recommended, particularly in beds where the soil had been sterilized. Most of the infections occurred where neither of those preventative practices was employed.

One grower in Hadley who practices fall-steaming of his bed soil, reported that the only place in his extensive outlay of beds where damping-off appeared involved 2 or 3 beds steamed for only 20 minutes. The remaining beds, steamed for 30 minutes, showed none. Infection was quickly checked by starting semi-weekly applications of Bordeaux spray. Both damping-off and bed rot this year were caused, at least in most instances, by Rhizoctonia. No cases of bacterial nor pythium bed-rot infections were observed.

Downy mildew [Peronospora nicotianae] was first reported in the State this year on May 16 by Wilbur T. Locke who verified a report from one of his growers in Hampden County. He estimated that the disease had been present for about 8 to 10 days. The disease was observed by Stanley L. Burt in South Deerfield and in Whately on May 19, and by myself in North Hadley the following day. These 2 infections had been present for about 2 weeks, and all 4 cases, no doubt, represented primary infections that started when the plants were not more than one inch high, from downy mildew oospores that had overwintered in the beds. During the following week, a few additional scattered primary infections were located in Hampshire and Franklin Counties, and secondary infections were beginning to appear in adjacent or closely neighboring beds. Not until about June 15 to 20 did secondary infections become numerous and general. Downy mildew was first identified in Connecticut this year by Dr. P. J. Anderson on May 6, a case of primary infection in South Windsor.

During the remainder of the field-setting and restocking season, up to the first week of July, the disease continued to appear and develop in untreated beds. In fact, by late June, downy mildew was or had been present in a larger number of beds than in any past season, probably in at least 3/4 of all beds. During the latter part of June and early July, it was not uncommon to find the disease in the fields either as a result of setting out diseased plants or of its spread there from nearby beds. However, its survival in the field was of short duration due to the unusually high temperatures on June 20 to 22, and June 27 to July 2. All cases observed of what appeared to be primary infections occurred in unsterilized beds. In most of these cases, the growers admitted the presence of mildew in their beds late in the 1940 bed season.

Damage from downy mildew this year varied from complete loss of plants in the beds in a few instances to little or no loss. As usual, however, quite a number of growers lost from 1/4 to 1/2 of their plants, and these, as well as those who lost the entire seeding, were forced to delay field setting or to obtain plants elsewhere for setting a portion or all of the acreage. It is believed that a larger number of growers not only encountered the disease this year but also experienced measurable losses from it, than in any past year.

Although not more than 4 or 5 percent of the growers undertook a recommended bed treatment for downy mildew when its presence was first reported, a larger number than in any past season used either the benzol or the paradichlorobenzene treatment after the disease appeared in the beds. It is estimated that around 15 to 20 percent of the growers gassed the beds this year at some stage of the season. Only a few of them, however, continued the treatment right through the field-setting and restocking season.

It is estimated that about 9 times as many growers employed the PDB crystals treatment as used the liquid benzol treatment. In the numerous cases where follow-up visits were made, it was observed that either primary or secondary infections were readily checked with PDB when used as recommended, but that poor results usually were obtained when the beds were not tight or where the treatment was not started early enough in the afternoon, or both. Some growers got around the latter obstacle by starting the treatment in the evening, about sundown, but waiting until 9 or 10 o'clock the following morning before opening the beds.

Observations during the past three seasons indicate that the late beds face a greater hazard than earlier beds, in regard to losses from downy mildew. This is especially noticeable in Hampden County where so many of the beds are cloth covered. The latter reach the field-setting stage from 1 to 2 weeks later than sash-covered beds seeded at the same time. The majority of the latter beds have been pulled by the time downy mildew becomes widespread, whereas plant pulling is usually just starting in most of the cloth-covered beds at that time, and these beds are thus much more subject to infection prior to and during field setting than the glass-covered beds. It therefore seems that cloth-covered beds and late-seeded sash beds should receive particular attention as regards precautionary treatment for protection against the extensive, late-season secondary spread of mildew.

Black root-rot [Thielaviopsis basicola] and brown root-rot [undet.] were about normal in their distribution and severity this year, i.e., in the ordinary strains of Havana tobacco. Both were more pronounced than in 1940, but caused about the same amount of damage as in most past seasons. It was striking to observe, while traveling from farm to farm, the increasing number of growers who are planting the black root-rot resistant tobacco, No. 211, and the corresponding decrease in the prevalence of that disease.

Sore-shin, a stalk-canker disease in the field that results from Rhizoctonia infection either in the bed or after field setting, was more noticeable generally this year than in most seasons. It may result from the continued development of a light bed-rot infection, or it may develop as a result of the fungus gaining entrance into the injured stem after the plant is set out. The unusual windwhipping the plants received this year (June 8 to 11) could readily account for injuries through which such soil-borne organisms might attack the plants.

MASSACHUSETTS STATE COLLEGE.

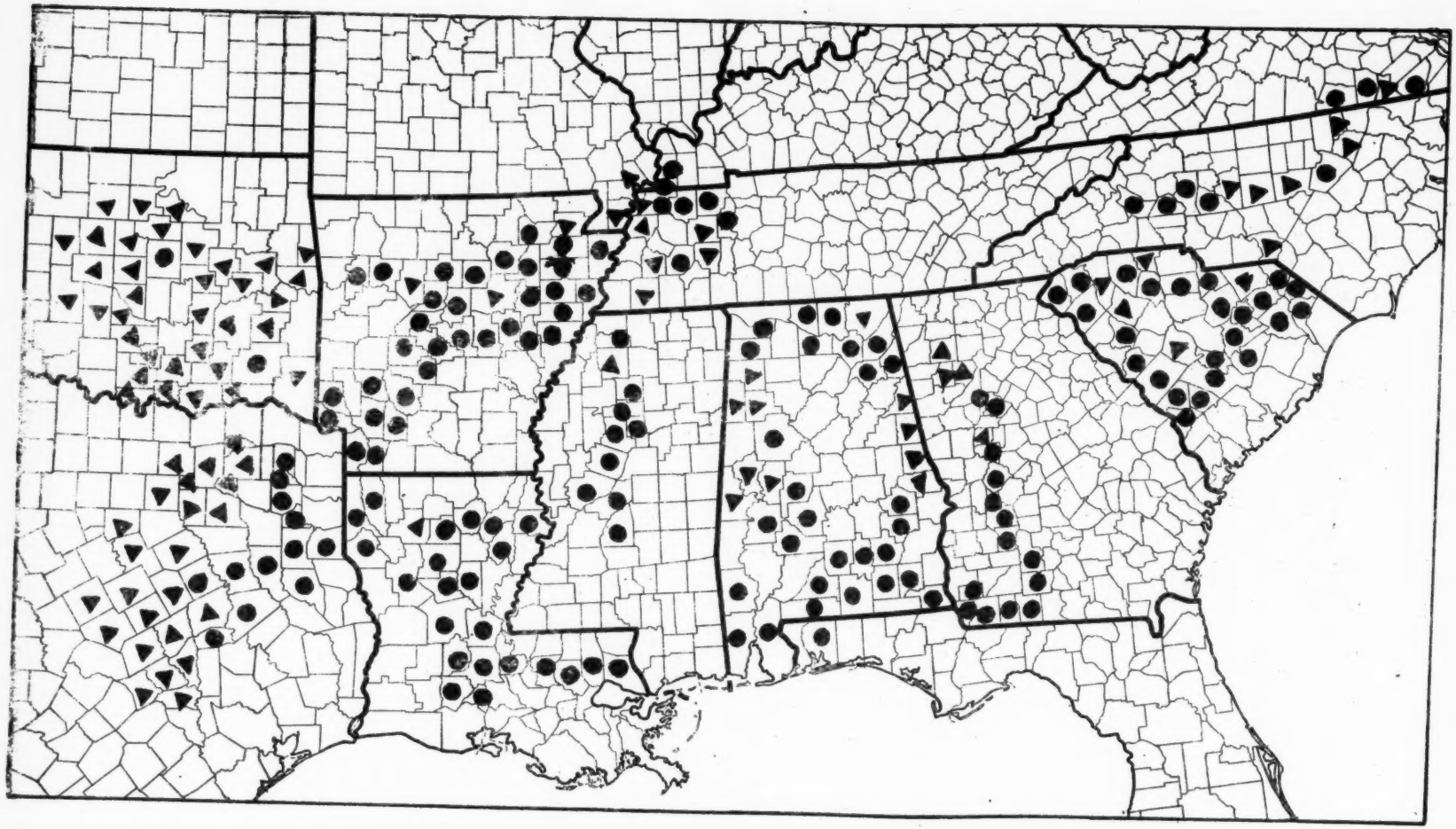

Figure 1. Counties included in the 1941 cotton boll-rot survey. Occurrence of *Glomerella gossypii* in cultures made from samples is indicated by : dot, *Glomerella* isolated; triangle, *Glomerella* not obtained.

A SURVEY OF COTTON BOLL ROT DISEASES AND ASSOCIATED MICROORGANISMS IN 1941

Paul R. Miller and Richard Weindling

During this fourth consecutive cotton boll disease survey, special emphasis was placed on securing a representative number of samples from west of the Mississippi River in order to gain additional information on the interesting distribution of anthracnose previously observed for this region. An effort was made, however, to obtain also a representative number of samples from the eastern areas, where more intensive surveys had been conducted for the past 3 years. There was a peculiar combination of factors in 1941 that may have affected the distribution and prevalence of microorganisms on cotton bolls: the heavy summer rainfall in the western region, the unusually heavy infestation of boll weevil in the Southeast, and much early defoliation of cotton due to leaf worms in the central southwestern areas. To improve uniformity in sampling, the first writer made all of the collections this year with the exception of those from South Carolina. Methods of collection, treatment, and culturing bolls were practically the same as described in a previous report (PDR 24: 417-423, 1940).

Results as presented in Tables 1 and 2 and in Figure 1 are generally consistent with those obtained during the 3 preceding boll disease surveys, in that Glomerella gossypii was the predominant pathogenic organism found on diseased bolls east of Texas and Oklahoma. As was the case during the 1941 seedling survey (PDR 25: 378-380, 1941), this organism was found somewhat farther west than it had previously been secured. In addition, it was isolated from a greater percentage of diseased bolls in Eastern Texas than from diseased bolls in general. (See Tables 1 and 2.)

An interesting observation made during this survey was that water-soaked spots commonly thought to be caused by Phytomonas malvacearum were neither as pronounced nor as abundant in most of the sections as during the past 3 seasons. Furthermore, the percentage of water-soaked spots yielding Phytomonas malvacearum upon culturing was much lower this year than last -- 13 percent as compared with 41 percent. A possible explanation is that in many cases the greater number of secondary organisms observed in culture plates hindered the isolation of the bacteria and also masked the typical water-soaked symptoms. DIVISION OF MYCOLOGY AND DISEASE SURVEY AND DIVISION OF COTTON AND OTHER FIBER CROPS AND DISEASES.

Table 1. Frequency of occurrence of microorganisms in sample lots of cotton bolls collected in the 1941 boll-rot survey, in terms of percentage.

State	Number samples cultured	Percentage of samples cultured showing: Glomerella gossypii	Fusarium moniliforme	Alternaria spp.	Fusarium spp.	Diplodia gossypina	Others	Percentage of samples in which Glomerella gossypii was found by: Culturing	Scraping: Bolls	Scraping: Bracts	Culturing & scraping	Percentage of samples from which P. malvacearum was isolated
Ala.	42	54.8	45.2	83.3	28.6	16.7	61.9	54.8	35.7	26.2	71.4	0
Ark.	37	81.1	59.5	97.3	64.9	8.1	29.7	81.1	70.3	18.9	91.9	16.2
Ga.	18	66.7	50.0	94.4	44.4	22.2	72.2	66.7	61.1	11.1	77.8	0
Ky.	2	100.0	0	100.0	100.0	0	6	100.0	50.0	50.0	100.0	0
La.	24	91.7	70.8	33.3	50.0	16.7	50.0	91.7	66.7	12.5	95.8	8.3
Miss.	10	80.0	40.0	90.0	50.0	10.0	40.0	80.0	10.0	4.0	90.0	0
Mo.	2	0	0	100.0	50.0	0	50.0	0	0	0	0	0
N.C.	11	45.4	18.2	100.0	18.2	0	81.8	45.4	0	9.1	45.4	18.2
Okla.	37	2.7	40.5	100.0	54.1	8.1	16.2	2.7	5.4	0	5.4	16.2
S.C.	48	70.8	62.5	87.5	31.3	6.3	52.1	70.8	47.9	12.5	75.0	12.5
Tenn.	12	25.0	33.3	100.0	50.0	0	50.0	25.0	16.7	8.3	41.7	16.7
Tex.	38	34.2	42.1	89.5	44.7	0	60.5	34.2	21.1	2.6	34.2	39.5
Va.	4	50.0	0	100.0	0	0	75.0	50.0	25.0	25.0	75.0	0
Total	285	54.4	48.4	87.4	43.5	8.8	48.7	54.4	37.2	13.3	61.8	13.7

Table 2. Frequency of occurrence of microorganisms in cultures from individual bolls expressed in terms of percentage.

State	Number bolls cultured	Percentage of bolls cultured showing						
		Glomerella gossypii	Fusarium moniliforme	Alternaria spp.	Fusarium spp.	Diplodia gossypina	Other fungi	Negative
Alabama	206	20.2	18.9	34.9	7.3	3.4	24.3	8.7
Arkansas	185	34.0	20.0	49.7	23.8	1.6	8.1	.54
Georgia	90	21.1	16.7	50.0	12.2	5.6	28.9	1.1
Kentucky	10	30.0	0	90.0	20.0	0	0	0
Louisiana	120	55.8	21.7	11.6	16.7	4.2	17.5	1.6
Mississippi	50	24.0	14.0	58.0	24.0	2.0	12.0	0
Missouri	10	0	0	90.0	10.0	0	10.0	0
North Carolina	55	14.6	5.4	63.6	3.6	0	20.0	7.3
Oklahoma	185	.5	10.3	87.6	13.0	1.6	5.4	1.62
South Carolina	240	36.3	21.3	37.9	12.1	1.2	21.7	1.7
Tennessee	60	6.7	11.6	75.0	11.6	0	11.6	0
Texas	194	23.7	13.4	46.4	16.0	0	21.1	5.7
Virginia	20	15.0	0	60.0	0	0	25.0	0
Total	1425	25.8	16.1	49.5	13.9	1.9	17.2	3.1